

## CLAIMS

1. An electronic component mounting method comprising:

aligning in position electrodes (5) of a circuit board (4) with bumps (3) formed by wire-bonding on electrodes (2) of an electronic component (1) with interposition of an insulative thermosetting resin (6, 6b) that includes no conductive particle; and

hardening with heat the thermosetting resin interposed between the electronic component and the circuit board while correcting warp of the board by pressurizing the electronic component against the circuit board with a pressure force of not smaller than 20 gf per bump, thereby bonding the electronic component and the circuit board together for electrical connection between both the electrodes thereof.

2. An electronic component mounting method as claimed in claim 1, wherein

the positional alignment is executed by aligning in position the electrodes (5) of the circuit board (4) with the bumps (3) formed by wire-bonding on the electrodes (2) of the electronic component (1) with interposition of the thermosetting resin (6, 6b) without performing leveling, and the bonding is executed by hardening with the heat the thermosetting resin interposed between the electronic

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component and the circuit board while simultaneously performing leveling of the bumps and correction of the warp of the board by pressurizing the electronic component against the circuit board with the pressure force of not smaller than 20 gf per bump, thereby bonding the electronic component and the circuit board together for electrical connection between both the electrodes thereof.

3. An electronic component mounting method as claimed in claim 1 or 2, wherein

the thermosetting resin is a thermosetting resin sheet (10) having an anisotropic conductive film.

4. An electronic component mounting method as claimed in claim 1, wherein

the positional alignment is executed after a solid thermosetting resin sheet (6) having a shape dimension smaller than an outside dimension (OL) of connection between the electrodes (2) of the electronic component (1) is stuck as the thermosetting resin to the circuit board (4) before the positional alignment, and

the bonding is executed by hardening with the heat the thermosetting resin sheet interposed between the electronic component and the circuit board while simultaneously performing the correction of the warp of the circuit board by pressurizing the electronic component against the circuit board with the heat applied to the

thermosetting resin sheet (6), thereby bonding the electronic component and the circuit board together.

5. An electronic component mounting method as claimed in claim 1, wherein

5 a conductive adhesive (11) is transferred onto the bumps (3) of the electrodes (2) of the electronic component (1) before the positional alignment,

10 the positional alignment of the bumps with the electrodes (5) of the circuit board is executed after a solid thermosetting resin sheet (6) having a shape dimension smaller than an outside dimension of connection between the electrodes of the electronic component is stuck as the thermosetting resin to the circuit board (4) before the positional alignment, and

15 the bonding is executed by hardening with the heat the thermosetting resin sheet interposed between the electronic component and the circuit board while simultaneously performing the correction of the warp of the circuit board by pressurizing the electronic component against the circuit board with the heat applied to the thermosetting resin sheet (6), thereby bonding the electronic component and the circuit board together.

6. An electronic component mounting method as claimed in claim 1, wherein

25 the positional alignment of the bumps (3) of the

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electrodes (2) of the electronic component (1) with the electrodes (5) of the circuit board is executed after a solid thermosetting resin sheet (6) whose one surface or both surfaces are provided with a flux layer (12) is stuck as the thermosetting resin to the circuit board (4), and

the bonding is executed by hardening the thermosetting resin sheet interposed between the electronic component and the circuit board while simultaneously performing the correction of the warp of the circuit board by pressurizing the electronic component against the circuit board by a heated head (8), thereby bonding the electronic component and the circuit board together as a consequence of the bonding of the bumps to the electrodes of the circuit board due to adhesion of a flux component of the flux layer to the bumps occurring when the bumps break through the resin sheet.

7. An electronic component mounting method as claimed in claim 1, wherein

the positional alignment of the bumps of the electronic component with the electrodes of the circuit board is executed after a solid thermosetting resin sheet (66) where particles (14) comprised of: resin balls whose surfaces are plated with gold; or nickel particles; or conductive particles made of silver, silver-palladium, or gold; or a conductive paste; or gold balls are embedded in a

direction in which the bumps and the electrodes of the circuit board are made mutually electrically continuous inside holes (15) formed in positions corresponding to either the bumps (3) of the electrodes (2) of the electronic component (1) or the electrodes (5) of the circuit board (4) before the positional alignment is stuck as the thermosetting resin to the electrode of the circuit board through positional alignment, and

the bonding is executed by hardening with the heat the thermosetting resin sheet interposed between the electronic component and the circuit board while performing the correction of the warp of the circuit board by pressurizing the electronic component against the circuit board with the heat applied to the thermosetting resin sheet (6).

8. An electronic component mounting method as claimed in claim 1, wherein

the positional alignment of the electrodes of the electronic component with the electrodes of the circuit board is executed after a solid thermosetting resin sheet (66) where particles (16) each of which has a size that is greater than a thickness ( $t_{pc}$ ) of a passivation film (1a) to be coated on at least the electrodes (2) of the electronic component and smaller than a thickness ( $t_{pcb}$ ) of one of the electrodes of the circuit board and each of which is

comprised of: resin balls whose surfaces are plated with gold; or nickel particles; or conductive particles made of silver, silver-palladium, or gold; or a conductive paste; or gold balls are embedded inside holes (15) formed in positions corresponding to either the electrodes (2) of the electronic component or the electrodes (5) of the circuit board in a direction in which the particles (16) are interposed between the electrode of the electronic component and the circuit electrode of the circuit board and in which the electrodes are made mutually electrically continuous before the positional alignment is stuck as the thermosetting resin to the electrode of the circuit board through positional alignment when mounting the electronic component (1) on the circuit board (4), and

the bonding is executed by hardening with the heat the thermosetting resin sheet interposed between the electronic component and the circuit board while pressurizing the electronic component against the circuit board with the heat applied to the thermosetting resin sheet (6) and with ultrasonic vibrations applied to the electronic component.

9. An electronic component mounting method as claimed in claim 3, wherein

the conductive particles included in the anisotropic conductive film (10) are nickel particles plated

with gold.

10. An electronic component mounting method as claimed in any one of claims 1 through 9, wherein

the thermosetting resin is provided by the thermosetting resin sheet (6).

11. An electronic component mounting method as claimed in claim 10, wherein

the thermosetting resin sheet (6) has a thickness greater than a gap between an active surface of the electronic component and a surface which belongs to the circuit board and on which the electrodes (5) thereof are formed after the bonding.

12. An electronic component mounting method as claimed in claim 1 or 2, wherein

the thermosetting resin is provided by the thermosetting adhesive (6b).

13. An electronic component mounting apparatus comprising:

a positional alignment device for aligning in position electrodes (5) of a circuit board (4) with bumps (3) formed by wire-bonding on electrodes (2) of an electronic component (1) with interposition of an insulative thermosetting resin (6, 6b) that includes no conductive particle;

a heating device (8a) for heating the

thermosetting resin (6, 6b); and

5 a bonding device for hardening with heat the thermosetting resin interposed between the electronic component and the circuit board while correcting warp of the board by pressurizing the electronic component against the circuit board with a pressure force of not smaller than 20 gf per bump with the heat applied to the thermosetting resin (6, 6b) from the heating device, thereby bonding the electronic component and the circuit board together for electrical connection between both the electrodes thereof.

10 14. An electronic component mounting apparatus as claimed in claim 13, wherein

15 the positional alignment device is to align in position the electrodes (5) of the circuit board (4) with the bumps (3) formed by wire-bonding on the electrodes (2) of the electronic component (1) with interposition of the thermosetting resin (6, 6b) without performing leveling, and

20 the bonding device hardens with the heat the thermosetting resin interposed between the electronic component and the circuit board while simultaneously performing leveling of the bumps and correction of the warp of the board by pressurizing the electronic component against the circuit board with the pressure force of not smaller than 20 gf per bump with the heat applied to the thermosetting resin (6, 6b) from the heating device, thereby

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bonding the electronic component and the circuit board together for electrical connection between both the electrodes thereof.

15. An electronic component mounting apparatus as  
5 claimed in claim 13 or 14, wherein

the thermosetting resin is a thermosetting resin sheet (10) having an anisotropic conductive film.

16. An electronic component mounting apparatus as  
10 claimed in claim 13, wherein

the positional alignment device sticks a solid thermosetting resin sheet (6) having a shape dimension smaller than an outside dimension (OL) of connection between the electrodes (2) of the electronic component (1) as the thermosetting resin to the circuit board (4), and thereafter  
15 executes positional alignment of the bumps (3) of the electrodes of the electronic component with the electrodes (5) of the circuit board, and

the bonding device hardens with the heat the thermosetting resin sheet interposed between the electronic  
20 component and the circuit board while simultaneously performing the correction of the warp of the circuit board by pressurizing the electronic component against the circuit board with the heat applied to the thermosetting resin sheet (6), thereby bonding the electronic component and the  
25 circuit board together.

17. An electronic component mounting apparatus as claimed in claim 13, wherein

a conductive adhesive (11) is transferred onto the bumps (3) of the electrodes (2) of the electronic component (1) before the positional alignment,

the positional alignment of the bumps with the electrodes (5) of the circuit board is executed after a solid thermosetting resin sheet (6) having a shape dimension smaller than an outside dimension of connection between the electrodes of the electronic component is stuck as the thermosetting resin to the circuit board (4) before the positional alignment, and

the bonding is executed by hardening with the heat the thermosetting resin sheet interposed between the electronic component and the circuit board while simultaneously performing the correction of the warp of the circuit board by pressurizing the electronic component against the circuit board with the heat applied to the thermosetting resin sheet (6), thereby bonding the electronic component and the circuit board together.

18. An electronic component mounting apparatus as claimed in claim 13, wherein

the positional alignment device sticks a solid thermosetting resin sheet (6) whose one surface or both surfaces are provided with a flux layer (12) as the

thermosetting resin to the circuit board (4), and thereafter executes the positional alignment of the bumps (3) of the electrodes (2) of the electronic component (1) with the electrodes (5) of the circuit board, and

the positional alignment hardens the thermosetting resin sheet interposed between the electronic component and the circuit board while simultaneously performing the correction of the warp of the circuit board by pressurizing the electronic component against the circuit board by a heated head (8), thereby bonding the electronic component and the circuit board together as a consequence of the bonding of the bumps to the electrodes of the circuit board due to adhesion of a flux component of the flux layer to the bumps occurring when the bumps break through the resin sheet.

19. An electronic component mounting apparatus as claimed in claim 13, wherein

the positional alignment device sticks a solid thermosetting resin sheet (66) where particles (14) comprised of: resin balls whose surfaces are plated with gold; or nickel particles; or conductive particles made of silver, silver-palladium, or gold; or a conductive paste; or gold balls are embedded in a direction in which the bumps and the electrodes of the circuit board are made mutually electrically continuous inside holes (15) formed in positions corresponding to either the bumps (3) of the

electrodes (2) of the electronic component (1) or the electrodes (5) of the circuit board (4), to the electrodes of the circuit board through positional alignment as the thermosetting resin, and thereafter executes the positional alignment of the bumps of the electronic component with the electrodes of the circuit board, and

the bonding device hardens with the heat the thermosetting resin sheet interposed between the electronic component and the circuit board while performing the correction of the warp of the circuit board by pressurizing the electronic component against the circuit board with the heat applied to the thermosetting resin sheet (6) so as to achieve the bonding.

20. An electronic component mounting apparatus as claimed in claim 13, wherein

the positional alignment device sticks a solid thermosetting resin sheet (66) where particles (16) each of which has a size that is greater than a thickness ( $t_{pc}$ ) of a passivation film (1a) to be coated on at least the electrodes (2) of the electronic component and smaller than a thickness ( $t_{pcb}$ ) of one of the electrodes of the circuit board and are comprised of: resin balls whose surfaces are plated with gold; or nickel particles; or conductive particles made of silver, silver-palladium, or gold; or a conductive paste; or gold balls are embedded inside holes

5 (15) formed in positions corresponding to either the electrodes (2) of the electronic component or the electrodes (5) of the circuit board in a direction in which the particles (16) are interposed between the electrodes of the electronic component and the circuit electrodes of the circuit board and in which the electrodes are made mutually electrically continuous, to the electrodes of the circuit board through positional alignment as the thermosetting resin when mounting the electronic component (1) on the circuit board (4), and thereafter executes the positional alignment of the electrodes of the electronic component with the electrodes of the circuit board, and

10 the bonding device hardens with the heat the thermosetting resin sheet interposed between the electronic component and the circuit board while pressurizing the electronic component against the circuit board with the heat applied to the thermosetting resin sheet (6) and with ultrasonic vibrations applied to the electronic component so as to achieve the bonding.

15 21. An electronic component mounting apparatus as claimed in claim 15, wherein

the conductive particles included in the anisotropic conductive film (10) are nickel particles plated with gold.

20 22. An electronic component mounting apparatus as

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claimed in any one of claims 13 through 21, wherein

the thermosetting resin is provided by the thermosetting resin sheet (6).

23. An electronic component mounting apparatus as  
5 claimed in claim 22, wherein

the thermosetting resin sheet (6) has a thickness greater than a gap between an active surface of the electronic component and a surface which belongs to the circuit board and on which the electrodes (5) are formed after the bonding.  
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24. An electronic component mounting apparatus as claimed in claim 13 or 14, wherein

the thermosetting resin is provided by the thermosetting adhesive (6b).  
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25. An electronic component mounting apparatus as claimed in any one of claims 12 through 14, wherein

the positional alignment device and the bonding device are constructed of one device.

26. An electronic component mounting method as claimed  
20 in any one of claims 1 through 12, wherein

a conductive paste (100) is applied to the bumps after the positional alignment and before the bonding, and thereafter the conductive paste is hardened to function as part of the bump, making the hardened conductive paste break  
25 through the thermosetting resin during the bonding for the

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27. An electronic component mounting apparatus as claimed in any one of claims 13 through 25, wherein

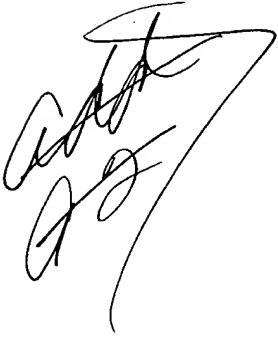
28. An electronic component/mounting method as claimed  
in any one of claims 1 through 9 or 11, wherein

29. An electronic component mounting method as claimed in any one of claims 1 through 9 or 11, wherein

30. An electronic component mounting apparatus as claimed in any one of claims 13 through 21 or 23, wherein

31. An electronic component mounting apparatus as claimed in any one of claims 13 through 21 or 23, wherein

the thermosetting resin sheet is arranged on a side of the electronic component.

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